Wisconsin Highway Research Program

Request for Proposals – FFY 2009

Problem Title:

Performance Evaluation of Tack Coat Materials

Background and Problem Statement:

Localized pavement sliding and shoving has been an ongoing concern for some hot mix asphalt (HMA) pavements in Wisconsin. While there are several factors that may lead to this distress, the bond provided by tack coat placed between HMA pavement layers is an important element to consider. Tack coat is intended to adhere pavement layers together and ensure that the layers act monolithically when subjected to traffic loads. Insufficient or improper application of tack coat can result in a weak bond between HMA pavement layers, causing the layers to act independently. This can lead to premature pavement distress. The type of tack coat used, condition of the adhering surfaces, rate of application, application temperature, and curing period are all factors that directly affect the development of the interlayer bond.

The intent of this laboratory-oriented study is to investigate tack coat performance using materials common in the Wisconsin paving industry. Several states have conducted similar research on tack coat performance. A study for the Louisiana DOT reported that the best performance was noted with CRS 2P tack coat.[1] A Washington Center for Asphalt Technology study of CSS-1 tack coat found that curing time and application rate did not significantly affect bond strength.[2] In addition, NCHRP study 09-40 is currently underway to provide guidelines for evaluation methods and performance of tack coat on a nation-wide basis.

Recently completed WHRP study 0092-02-13 investigated interlayer slippage in several Wisconsin pavements.[3] The results of this study indicated that the probability of slippage could be correlated to the stiffness ratio between HMA pavement layers. A higher stiffness ratio indicated lower risk of slippage between pavement layers. It was reported that to achieve a higher stiffness ratio and thus reduce the probability of slippage, the thickness of the surface layer could be increased. To expand on these results, this study will investigate a means to reduce the risk of slippage by utilizing tack coat material so that its full bonding capacity is realized.

Scope:

This research will investigate the adhesion properties of tack coats, including but not limited to emulsions, modified emulsions and paving grade binders, by evaluating the following parameters:

1. tack coat application rate,
2. tack coat application temperature,
3. curing period of tack coat, and
4. condition of the adhering surfaces.

A partial factorial design is envisioned to encompass an appropriate testing range for the parameters listed above. The researcher will supply a test matrix in the research proposal to outline the scope of study. Part of the proposal evaluation will be based on the extent of testing proposed.

Potential methods to test the adhesion of tack coats include a simple shear test, the simplified NCAT bond strength test, the UTEP pull-off test, and the torque bond test.[2] Other tests may be used as well. The researcher will designate in the research proposal what test method(s) will be used to evaluate the parameters listed above.

In the research proposal, the researcher will also indicate what test materials will be studied, how test materials will be obtained, accessibility of appropriate test equipment and facilities, and what analysis methods will be used in the evaluation of test data.

Specific Results, Findings, Tools, etc. (Deliverables):

1. Evaluation of the adhesion characteristics of tack coats according to the proposed test matrix.
2. Discussion of the qualitative relationship between the laboratory results and expected field performance.
3. Recommendation of the appropriate combination of tack coat material and construction procedures (including application rate and temperature, curing period, and surface condition) that results in satisfactory performance at the lowest cost.
4. 40 printed copies of the final report for WisDOT (34) and WHRP (6), as well as an electronic version of the final report.

Length of Research Project and Approximate Cost to Complete:

Proposals for up to 18 months of research and a total project cost of $72,000 will be considered. The project timeframe is based on a start date of October 1, 2008 and a final completion date of March 31, 2010. A draft final report, along with a closeout presentation to the Technical Oversight Committee (TOC), is due no later than December 31, 2009.

Urgency and Potential Benefits:

Findings will allow WisDOT to ensure that cost-effective tack coats are used in HMA pavement construction, and provide a basis to evaluate whether tack coats are properly applied in the field. This will result in increased confidence that HMA pavements will not show signs of slippage and shoving in the future.

Additional Requirements for Implementation:

Upon acceptance of the researcher's recommendation(s), the results can be directly implemented in WisDOT HMA pavement design and construction.

Implementation may be in the form of changes to the WisDOT Standard Specifications, training for paving crews on the appropriate application of tack coats, or a combination of both.

References:

1. Mohammad, L. N., Raqib, M. A., and Huang, B., "Influence of Asphalt Tack Coat Materials on Interface Shear Strength," *Transportation Research Record 1789*, Paper No. 02-3301, 2002, pp. 56-65.
2. Tashman, L., Nam, K., Papagiannakis, T., "Evaluation of the Influence of Tack Coat Construction Factors on the Bond Strength Between Pavement Layers," Washginton Center for Asphalt Technology, Report No. WA-RD 645.1, Aug. 2006, 91 pp.
3. Mehta, Y., and Siraj, N., "Evaluation of Interlayer Bonding in HMA Pavements," Final Report, Wisconsin Highway Research Program, Study No. 0092-02-13, Dec. 2007.